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Présentation d'une méthode permettant d'étudier la structure et le niveau des salaires du personnel enseignant des universités ainsi que de déterminer les différences salariales qui existent entre les universités. Elaborée lors d'une étude menée par la Conférence des recteurs, cette méthode permet de diviser en deux composantes l'écart entre le salaire moyen versé par chaque université et celui versé par l'ensemble des établissements. Ces composantes reflètent pour une part les différences tenant aux caractéristiques des enseignants (expérience, statut--), pour l'autre les politiques salariales propres à chaque université.

Une telle méthode présente des avantages de deux types. Elle quantifie l'effet de distribution généralement pris pour acquis et laissé de côté lorsqu'une analyse des écarts salariaux est effectuée à l'aide de la technique des variables auxiliaires. Elle réunit la technique de la comparaison des moyennes et celle de l'analyse de régression de sorte que cette dernière technique puisse servir à interpréter et à justifier les résultats de la première.

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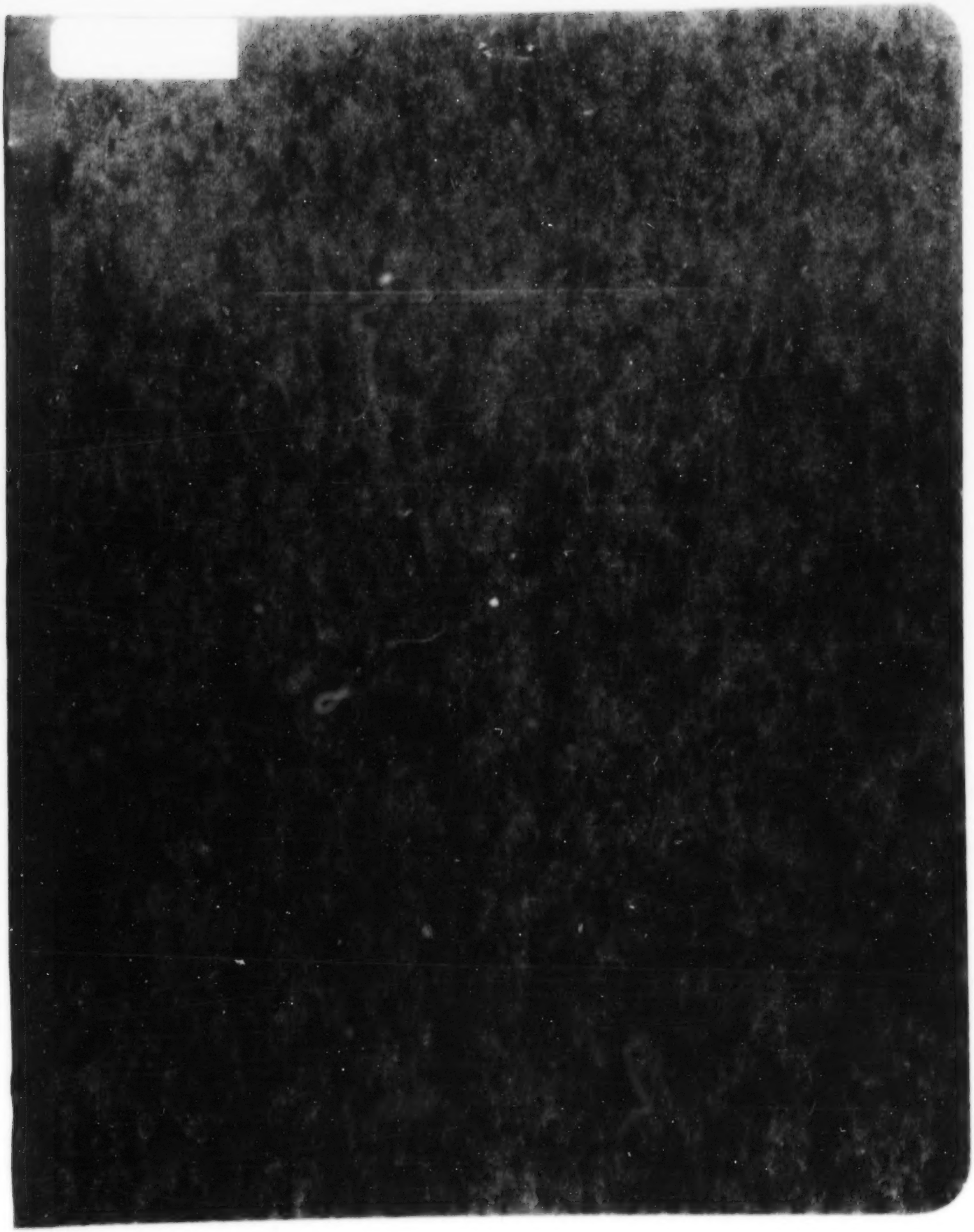

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Faculty salaries: analysing the difference between average salaries in terms of distribution effect and salary effect

Paper presented at the twentieth annual forum of
the Association for Institutional Research
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Atlanta, Georgia

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Conference of Rectors and Principals
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INTRODUCTION

This paper reports on the method which has been used in a study conducted at the Conference of Rectors of Quebec Universities to analyze the structure and the level of faculty salaries and to determine salary differentials between universities. The results of that study are being used by universities to evaluate their salary policies in the course of the salary discussion which take place with faculty unions in most universities and with faculty associations in the others.

More precisely, this paper focuses on the particular method used for this analysis. This method breaks down into two components the difference between the average salary observed in each institution and the average salary of the whole system: one component reflects the difference in average salary resulting from differences among universities in the characteristics of their teachers and the other reflects the difference exclusively attribuable to salary policies or pratices. The advanges of the method are the following: 1) it quantifies the distribution effect which is usually considered as accounted for and left aside when the analysis of salary differentials is performed with the technique of dummy variables and 2) it integrates the simple technique of comparing averages and the more sophisticated technique of regression analysis in such a way that the results of the second technique can be used to qualify the observations that can be made from the first.

The method can be applied in either one or in a combination of two ways. The first application uses as input for each pair of institutions compared: 1) the percentage distribution of faculty by categories and, 2) the average salaries in each of those categories (for example, ranks). The output is the breakdown of the difference between the aggregate average salary at the two universities between the part due to the difference in the distribution by rank and the part which is due to the difference attributable to salary levels

in each category.

The second application uses as an input: 1) the regression coefficients estimated from observations in each of the institutions and 2) the two sets of mean values of the independant variables of these regressions. This application gives a measure of the difference between average salaries attributable to variables like age or some other measure of experience.

The two applications of the technique could also be combined by using, for example, a regression model in each rank and the distribution by rank.

These two applications are presented in the two parts of this paper. They are illustrated with results obtained in the study conducted at the Conference of Rectors. At the end of the second part, we discuss the problems which arise when we compare the results of the second application to those we obtain if we combine the two applications.

1. BREAKDOWN OF DIFFERENCE BETWEEN OVERALL AVERAGE SALARIES USING AVERAGE SALARIES AND WEIGHTS BY CATEGORY.

In analysing salary differentials between different subpopulations, the central question is: what is left as a salary differential once we have taken account of the different factors considered as being likely to have an impact on the salary level. In fact, the question is: how can one take account of these factors and isolate the specific salary differential.

The most commonly used technique is that of dummy variables which gives an estimate of the salary differential between two populations. This technique is usualy used within a model which includes a numerical variable. Its main disadvantage is that it does not give any information on questions such as: for what section of the age range is the salary structure in one university higher than that of another one? For what section is it lower? These questions are important for purposes of comparing salary policies and for decision making in that area. So we preferred an approach which described more explicity the salary structure peculiar to a given university, and it is by taking this détour that we found in a subsequent exercise that the dummy variable method was a particular solution of the general problem of comparing salary structures.

Instead of introducing a dummy variable in a regression model where we have some other numerical variable, we used regression analysis within different subpopulations, and used a method for measuring salary differentials from the results of the regression equations estimated on these subpopulations.

In order to see how this method, which allows the breakdown of salary differentials between two groups into a distribution effect and a strict salary effect, operates, it might be useful, before applying it to the more difficult case of regression analysis, to see how it works in the simple case where we simply have a distribution of faculty by category and the average salary in these categories.

In this exercise, the overall difference between average salaries are split between 1) a component due to the difference in the distribution of faculty members among specific categories and 2) a component that could be considered as due to the difference of salary levels in these categories. In this first step, we assume that within each given category, the average salary is a good representation of the salary practice peculiar to that category.

1.1 Academic rank and discipline as categories.

The first category that comes to mind in the case of faculty is that of academic rank. When a university has a greater proportion of its faculty in the senior ranks, as compared to another, one must expect that university to show a greater average salary. The first exercise proposes systematic appoach to analyse this difference.

The other very important category considered when comparing salaries between faculty of different universities is the field or discipline. The faculty labor market has traditionally provided for positive salary differentials in favor of certains disciplines like medecine, law, engineering and commerce, for instance.

These differences in salary between disciplines are likely to be observed as long as there are salary differentials between occupations in the economy and to the extent that the external market influences the internal market of university faculty members. Since there are such salary differentials between disciplines, the differences in the mix of disciplines between two universities can explain part of the global average salary differential between them.

At the outset of our study, we broke down our population into a taxonomy of some 30 disciplines on which we performed a sequence of analyses using the technique of dummy variables in order to identify those disciplines showing salary differentials. After some iterations, we observed significant salary differentials for the following categories:

1. Medecine (doctors)
2. Medecine (non-doctors)
3. Administration
4. Engineering
5. Law
6. Other

We performed a separate study of interuniversity salary differentials for each of those groups. The faculty included in the category "other" we refer to as "the homogeneous group" in the sense that there is no significant salary differentials between the disciplines included.

For this presentation, we will use the results of the analysis performed with this homogeneous group of 4,130 professors of Quebec universities. This number represents 68.2% of the total. As far as individual universities are concerned, the results for three of them will be used for purposes of illustration. It was decided not to identify them in order to avoid detailed discussion of the institutional characteristics of the universities concerned and to focus on the methodological aspects of the study. These universities were selected according to their relative salary position, one being over the average, another below and the other close to the average.

Other variables such as degree or sex were also considered and some differences were found on those counts in certains institutions. We did not consider them in the analysis because the differentials were either marginal or belonged to one or two insitutions, and also because our purpose was to compare salary policies using variables that explicitely enter into the determination of salaries according to the collective agreements or the protocoles in the case of those institutions that have no union. In fact, the purpose of the study was not to produce the best analytical model of the differences between individual salaries. It was to produce qualified statements about the overall equivalence of salary policies or practices when we take account of generally accepted factors of differentiation.

1.2 The impacts of distribution and salary level by category on the overall average salary.

To start with a simple presentation of the problem, let us recall that the total payroll is the sum of individual annual salaries, and the average salary is this total divided by the number of observations. While it is easy to compare the salary level of two individual faculty members employed in two different universities and possessing identical characteristics (two PhD's obtained at the same university at the same time, in the same field of study, with the same course load at the universities where they teach, etc...), the problem we have to address is that of drawing conclusions about differences between groups. We thus have to find a way to relate salary levels with individual characteristics in some summary fashion.

The simplest way is to form significant subpopulations of teachers according to accepted criteria, and to consider the aggregate average faculty salary in a given university as being a weighted sum of the average salary within each of these categories. Assuming that academic rank it such a category, and that we have four academic ranks, the simple algebra of summation, division and weighting can be summarized as follows:

$$\bar{T}_u = \frac{1}{N}(n_1 T_u^1 + n_2 T_u^2 + n_3 T_u^3 + n_4 T_u^4) \qquad (1)$$

$$= w_1 T^1 + w_2 T^2 + w_3 T^3 + w_4 T^4 \quad , \text{ where}$$

$N = n_1 + n_2 + n_3 + n_4$ is the sum of the number of teachers in each rank.

$\bar{T}_u$ is the average salary, all ranks

T_u^i is the average salary in rank $i (i=1,\ldots,4)$

$w_i = \frac{n_i}{N}$ is the weight of the rank.

This weight is the proportion of faculty members in a given rank with respect to the total.

These statements can be simplified by using matrix notation. With this notation, we can represent equation (1) which describes the weighting operation, by the simple following statement:

$$\bar{T}_u = w' T \qquad \text{where} \qquad (1)$$

$$w' = \begin{pmatrix} w_1 & w_2 & w_3 & w_4 \end{pmatrix} \quad \text{and}$$

$$T_u = \begin{pmatrix} T_u^1 \\ T_u^2 \\ T_u^3 \\ T_u^4 \end{pmatrix}$$

It is easily seen that this notation is a way of expressing the sum of a product: it instructs the reader to take the sum of the products of every element in the premultiplying line vector (w') by the corresponding element in the postmultiplying column vector (T).

1.3 The salary effect and the distribution effect.

It follows from the definition of average salaries presented in the previous section that, when comparing two average salaries, one has to take account of a) differences in the rate of compensation and b) differences in the distribution of faculty members among selected categories: Thus

$$\bar{T}_a - \bar{T}_b = w'_a T_a - w'_b T_b \qquad (2)$$

where the subindices are used to identify a given university.

If one could find a way to express separately

$$(w_a - w_b) \text{ and } (T_a - T_b),$$

it would then be possible to make a systematic distinction between 1) the distribution impact on the difference between average salaries and 2) the salary impact. In order to do this, we need to find a conversion vector, that is, a vector of elements defined in such units that the units in each of the vector of simple differences would be converted into comparable units. Since the vector of differences in percentage points could give a dollar figure only if postmultiplied by salary figures, and since the vector of salary differences would give a dollar figure if weighted with a given percentage distribution, the problem is that of finding appropriate and meaningful conversion vectors.

A way to find such a vector would be to imagine a kind of simulation often used by salary analysts to compute what would be the average salary in a given institution if the faculty of each rank were paid according to the salaries paid in another university, that is to compute

$$w'_a T_b$$

It would then be possible to compare the simulated average salary rate to the real one, that is to use

$$w'_a T_a - w'_a T_b = w'_a (T_a - T_b)$$

as a measure of the aggregate difference between the real average salary in university "a" and the salary that would prevail if the same rates as paid in university "b" were applied. The vector "w_a" is the conversion vector transforming simple differences into a dollar amount.

Similarly, we could use

$$w'_a T_b - w'_b T_b = (w_a - w_b)' T_b$$

to measure the difference between the simulated and the real overall average salaries attributable to the differences in the distribution of faculty members among categories, assuming that the salary rates paid are those paid in the university to which university "a" is comparing its situation. Here, "T_b" is the conversion vector: it transforms differences in points of percentage into a given amount expressed in dollars.

The algebraic term that describes the above-mentioned simulation could be inserted twice (once with a plus and once with a minus sign) in the equation that develops the difference between aggregate average salary as a function of what happens in the subpopulations, to give

$$\bar{T}_a - \bar{T}_b = w'_a T_a - w'_a T_b + w'_a T_b - w'_b T_b$$

and the terms can be rearranged to present the two measures:

$$\bar{T}_a - \bar{T}_b = w'_a (T_a - T_b) - (w_a - w_b)' T_b \qquad (3)$$

The first term on the right measures the impact of differences in salary levels by categories on the difference between overall average salaries (the salary effect) and the second measures the impact of differences in the distribution of personnel among categories on the difference between overall average salaries (the distribution effect).

1.4 The definition of a referential.

In order to make significant comparisons between pairs of universities, one could first compare each one to every other one, which would give a set of n(n-1) results but each of them could then be considered as "institutionally" confidential. To have a smaller number of results to analyse

and still be able to draw sufficiently precise inferences about the situation of every university relative to that of every other one, it is preferable to fix one term of the comparison and to compare the situation of each university to this fixed common term of reference, or referential. For our empirical application, we decided to compare the situation in every higher education institution in Quebec to a standard corresponding to the aggregate population of teachers in the whole system.

This decision has the important consequence that the measured differentials are smaller in absolute terms than if we had compared the situation of each university to that observed in the complementary subset that is, in the set of all other institutions excluding the one we are comparing. This approach would have had the following inconvenience: the term of reference would have been different for each university and this would have prevented the possibility of transitive statements. In other words, it would have been more difficult to make a judgment on the relative situation of pairs of universities than it is when each one is compared to a common standard. Therefore we used as a referential the rate of pay and the distribution by category that we observe in the total population of Quebec university faculty members.

Changing the subindices of equation (3) to identify the referential defined in the preceeding paragraph, we have

$$\bar{T}_u - \bar{T}_r = w'_u(T_u - T_r) + (w_u - w_r)' T_r \qquad (4)$$

which gives a positive result for the salary effect when the salary level in university "u" is higher than in the referential for the numerically more important categories of faculty members. The distribution effect is also positive when faculty of a given university is more concentrated than in the referential in categories where the salary level is high.

1.5 The rank distribution effect in three Quebec universities.

We present in table 2 the initial data for "w" and for the vector of salaries, T, in three universities and in all the universities of Quebec, along with the difference between each element of these vectors and their value in the referential. The information contained in this table is needed to compute the adjusted value of the salary effect and the distribution effect presented in table 1.

Table 1. Breakdown of the difference between average salaries in three Quebec universities and the average salary for the whole system (first approximation)

	Average salary	Gross differential		Distribution by rank effect		Salary effect	
		$	%	$	%	$	%
University A	28,575	341	1.2	435	1.5	-94	-0.3
University B	27,002	-1,232	-4.6	-1,332	-4.9	100	0.4
University C	27,832	-402	-1.4	152	0.6	-553	-2.0

The average salary for all universities is $28,234
Source: Table 2

To illustrate the method of computation, the following has been done for university B:

$$(w_b - w_r)' T_r = \begin{bmatrix} -.048 & .1638 & -.0034 & -.1124 \end{bmatrix} \begin{bmatrix} 19,830 \\ 23,413 \\ 29,270 \\ 36,614 \end{bmatrix} = \$100.$$

Table 2

Average salary and relative importance of faculty ranks in three Quebec Universities in 1977-78: compared with the average salaries and weights in all universities*

Rank \ University	University A		University B		University C		all universities*
	level	difference	level	difference	level	difference	
Lecturer							
Average salary $	21,280	1,450	18,128	-1,702	18,138	-1,692	19,830
weight %	16.48	7.98	3.70	-4.8	4.94	-3.56	8.50
Assistant							
Average salary $	24,918	1,505	23,609	196	22,165	-1,248	23,413
weight %	22.65	-7.91	46.94	16.38	26.75	-3.81	30.56
Associate							
Average salary $	29,432	162	29,563	293	29,009	-261	29,270
weight %	29.82	-9.94	39.42	-0.34	52.67	12.91	39.76
Full professor							
Average salary $	34,289	-2.325	36.164	-450	36,625	11	36,614
weight %	31.05	9.87	9.94	-11.24	15.64	-5.54	21.18
Total							
Average salary $	28,575	341	27,002	-1,232	27,832	-402	28,234
%	100.00	0.0	100.00	0.0	100.00	0.0	100.00

These results summarize much information for each university. For university A, where the average salary is higher in all ranks but that of full professor, the negative difference in this rank and the relative weight of this rank results in an overall average salary differential of .3% below that of the whole system. On the other hand, the importance of this rank would explain why the average salary in this university would be 1.5% higher than the average salary for all universities. For university B, it is clear that the strong concentration of faculty members in the second rank (16.4 percentage points over the percentage for all universities) explains the large negative distribution effect among ranks. In university C, we have again a pattern where the distribution effect and the salary effect have opposite signs, but since the negative salary effect is much larger, the overall difference is negative.

We should mention that up to now, the analysis assumed that faculty members of a given rank had the same characteristics in all universities. If we relax this assumption, the differences in characteristics between universities within a given rank could produce a new breakdown that could be considered as a refinement of the salary effect already calculated at the rank level. Before we look at the way this method of breaking down interuniversity salary differentials in two components can be applied to estimated regression coefficients instead of average salaries, let us discuss a small but intriguing technical problem.

1.6 Assymetrical results and the joint effect.

If the absolute value of the difference between average salaries is the same irrespective of the terms of comparison

$$\left(\text{that is: } \left|\bar{Y}_a - \bar{Y}_b\right| = \left|\bar{Y}_b - \bar{Y}_a\right|\right),$$

a different situation occurs when this difference is broken down into a salary effect and a distribution effect:

$$-w'_a(T_a - T_b) \neq w'_b(T_b - T_a) \text{ and}$$

$$-(w_a - w_b)' T_b \neq (w_b - w_a)' T_a$$

Clearly, the fact that the conversion vector changes when the terms of comparison are reversed has the consequence that the distribution effect and the salary effect computed with the method presented have different values when we compare university A to university B instead of the latter to the first.

What is the source of this difference?

It is easily found when we add the two different results corresponding to the two possible orders of comparison with a pair of institutions. Moreover, by doing so successively for the salary component and the distribution component, we find two results which have the same absolute value.

The two salary components add the following way:

$$w'_a(T_a - T_b) + w'_b(T_b - T_a) = (w_a - w_b)' (T_a - T_b) \text{ and}$$

the distribution components:

$$(w_a - w_b)' T_b + (w_b - w_a)' T_a = (w_a - w_b)' (T_b - T_a)$$

$$= -(w_a - w_b)' (T_a - T_b)$$

This result, which is the product of the simple differences in the distribution vectors and the simple differences in the salary vectors will be called the joint effect. This effect measures exactly the difference between results obtained according to the choice of either one of the two possible referentials among a pair of institutions. It is important to take note of its existence in order to be well aware of the importance of the choice of a conversion vector when aggregating the results of an analysis of salary differentials in a set of categories.

When comparing the salaries of two groups distributed over a certain set of categories, once we have calculated the simple differences between average salaries in each category, how should we aggregate these results to have an overall measure of the salary differential between those two groups? It is evident that the result will be different if we weight the difference within each category by 1) the distribution by category which prevails in the first group, 2) the distribution observed in the second group or by 3) any combination of these two distributions.

As a particularly significant example of the third possibility, let us take the half an half combination which in effect measures salary differentials given equal distribution for the two reference groups and distribution differentials given equal salary structure. This solution gives symmetrical results, that is: the salary effect and the distribution effect have the same absolute value whatever may be the order of the comparison. It takes the form:

$$\bar{T}_a - \bar{T}_b = \left(\frac{w_a - w_b}{2}\right)'(T_a - T_b) + (w_a - w_b)'\left[\frac{T_a - T_b}{2}\right] \quad (5)$$

This can be derived by breaking down the joint effect into two halves in the following equation:

$$\bar{T}_a - \bar{T}_b = w_b'(T_a - T_b) + (w_a - w_b)' T_b + (w_a - w_b)' (T_a - T_b)$$

2. USING THE RESULTS OF REGRESSION ANALYSIS TO BREAK DOWN THE DIFFERENCES BETWEEN AVERAGE SALARIES.

When it comes to analysing the estimated parameters of a regression model, even people who have completed a statistics course covering the topic can feel a bit uncomfortable about drawing conclusions. On the other hand, it is almost as if we had all been born with the concept of a mean defined as the sum of the values of a variable divided by the number of observations.

Perhaps the discomfort could be eased and a more critical look given at what could be considered as innate understanding if one realizes that computing a mean is something like estimating the parameters of a model with the ordinary least squares technique: the formula to compute a mean could be derived from the application of the least squares criterion.

What model is implicitly refered to when using a mean? Let us state it the following way:

$$T_i = \bar{T} + u_i \qquad (6)$$

Where T_i is the observed salary level for individual faculty member i (i = 1,... n)

$\bar{T}$ is the fixed value considered as representing the salary level of the population on which the model is estimated

u_i is the difference between the estimated salary $\bar{T}$ and the observed salary of teacher i.

The classical regression model assumes that the u_i are normally distributed. And if we look at how to compute T in order to minimize the summation of u_i^2, we derive the following known formula:

$$\bar{T} = \frac{1}{n} \sum_{i=1}^{n} T_i$$

In fact, it is this kind of model that was assumed when we used the average salary by rank as a representation of individual salaries in the previous section.

But the least squares technique is more useful in estimating the parameters of progressively more sophisticated models. One more step in this direction is to consider the salary of an individual as being proportionnal to something like his age. The algebraic formulation of this model would be:

$$T_i = \beta \cdot AGE_i + v_i \qquad (7)$$

where, in addition to previously defined notation,

β is the coefficient of proportionality between age and salary

AGE_i is the age of teacher i; and

v_i the discrepancy between the observed salary of the teacher and his salary as estimated by the model.

Here again, the least squares criterion allows to derive a formula to compute the proportionality parameter.

If we consider an intermediate model between the fixed value model and the proportional model, that is a model which includes a fixed component and a component which is proportional to a given numerical value, let's say age, number of years of experience or something else, we then have the classical two variables linear model:

$$T_i = \beta_0 + \beta_1 \cdot AGE_i + w_i \qquad (8)$$

Where β_0 is the constant parameter of the model

β_1 is the parameter which indicates the amount of salary variation which is related to a unit variation in the number of years of age.

Perhaps the reasons why that kind of model is in some manner less attractive is that instead of giving a simple figure like the fixed value model, or some kind of a factor of proportionality which can be computed by simple multiplication, like in the proportional model, we now have a rule for the determination of the salary level of an individual faculty member and this rule must be applied to the whole range of years of active age or years of experience. The application of

this rule implies computations that cannot be done mentally, but require at least a pencil and a paper, preferably a small computing machine or even a computer, in a world where computer capacity is sometimes under-utilized.

From this short introduction to regression model building, we can go more deeply into the details of the specific models we estimated.

2.1 The measure of experience and the estimated models.

The principal numerical variable that is generally accepted as being related to the level of salary is some measure of experience. It is generally agreed that as time goes on, a university teacher can improve his performance as far as teaching and research are concerned, and that eventually this performance can level off and eventually decline. It would be interesting to explain how this improvement takes place, but this is not our purpose here. We assumed this kind of earnings profile and were interested in finding a measure of this characteristic referred to in the expression "an experienced professor". With individual data on the date of birth and the year when the various degrees were obtained, it is possible to measure experience by age or by the number of years elapsed since a given degree was granted. We used as a measure of experience the number of years elapsed since the time when the Bachelor's degree was granted.

In table 3, we present, together with figures on average age and average experience as defined, figures on average salaries by rank in the universities chosen for illustration. Looking at this table, one may note some observations which stress the relation that we mentionned between salary and age or experience. For example, in the rank of full professor, the universities where the average salary is lower than it is for all universities together are also those where the average age and the average number of years of experience are lower than the average for all universities. But the average salary is not the lowest in the university where the average experience is the lowest. This raises questions

Table 3

Salary, age and years of experience of faculty, by rank, in three Quebec universities in 1977-78: average values and differences with respect to the total system

University / Rank	University A		University B		University C		all universities
	average	difference	average	difference	average	difference	
Lecturer							
salary	21,280	1,450	18,128	-1,702	18,138	-1,692	19,830
experience	8.24	-.51	5.16	-3.59	9.83	1.08	8.75
age	31.53	-.2	27.53	-4.2	31.46	-.27	31.73
Assistant							
salary	24,918	1,505	23,609	196	22,165	-1,248	23,413
experience	11.94	-.11	10.71	-1.34	14.55	2.5	12.05
age	35.21	.41	33.53	-1.27	36.21	1.41	34.8
Associate							
salary	29,432	162	29,563	293	29,009	-261	29,270
experience	17.41	-1.43	16.27	-2.57	20.77	1.88	18.84
age	40.93	-0.62	39.95	-1.6	42.26	0.71	41.55
Full professor							
salary	34,289	-2,325	36,164	-450	36,625	11	36,614
experience	25.87	-1.0	23.16	-3.71	29.34	2.47	26.87
age	49.39	-0.37	47.38	-2.38	51.84	2.08	49.76
Total							
salary	28,575	341	27,002	-1,232	27,832	-402	28,234
experience	17.29	-.32	13.94	-3.67	19.88	2.27	17.61
age	40.71	-.32	37.22	-3.17	41.60	1.21	40.39

such as: in the university where the average salary is higher than for the total, is it higher in "proportion" to the difference in the distribution of faculty by years of experience? This is the kind of question we will examine using the results of our estimated regression models. But before describing the breakdown of the difference in average salaries with this technique, let us present first the three models we estimated.

The first model is the AGE model. To the age variable previously mentionned, we added a second degree variable, the square of age, to allow for a maximum in the function. Whence the model:

$$T_i = \alpha_0 + \alpha_1 AGE_i + \alpha_2 AGE_i^2 + u_i \qquad (9)$$

Where α_0, α_1 and α_2 are the estimated coefficients

The second model has quite the same structure as the first one: we just replaced the variable age by the variable experience, defined as the number of years elapsed since the individual obtained his Bachelor's degree:

$$T_i = \beta_0 + \beta_1 EXP_i + \beta_2 EXP_i^2 + v_i \qquad (10)$$

Where β_0, β_1 and β_2 are the coefficiants to be estimated and

EXP_i represents the value of the experience variable for teacher i

The third model we considered when we tried to choose between the AGE model and the EXPERIENCE model. Thinking a little about the relationship between age and experience as already defined, one can identify a third variable: the age at the time when the Bachelor's degree was granted, which is tautologically related to the other two.

Thus:

$AGE_i = EXP_i + BACHAGE_i$ where

$BACHAGE_i$ is the age of the individual teacher i at the time he obtained his Bachelor's degree

We then simply add the variable BACHAGE to the EXPERIENCE model, thus providing a way to separate the contribution made to the salary level by the years before the bachelor's degree and the years elapsed since that time. This model could be considered as a general model which may help to avoid a priori discussion on the relative merits of the two previous models. This model may be algebraically stated the following way:

$$T_i = \gamma_0 + \gamma_1 EXP_i + \gamma_2 EXP_i^2 + \gamma_5 BACHAGE_i + w_i \qquad (11)$$

where the gammas designate the coefficients

We applied the models to the population of teachers within each university and each rank, and then to the population of each university, all academic ranks. The results are presented in table 4 for the BACHAGE model.

In table 5, we summarize the results of the three models. It can be noted that in rank 1 for universities B and C, the values of the R^2 indicate that the results are of too poor quality to be considered as correctly describing the salary structure in these university-ranks. They were thus eliminated before proceeding with further analyses. Moreover, among the 17 groups where there is a best model (in rank 3, university C, two models have the same performance), the BACHAGE model is the best descriptor in 12 cases, the AGE model in 3 cases and the EXPERIENCE model twice.

Table 4

Estimated coefficients and mean values of the variables of the BACHAGE regression model, by rank and university, three individual universities and all universities, Quebec, 1977-78

	Coefficients and mean values of the variables						Characteristics of the regression		
	Constant	Experience		Experience^2		Age at graduation[a]		R^2	Standard error	Coefficient of variability
		mean	coefficient	mean	coefficient	mean	coefficient			
Lecturer										
A	12,182	8.24	460.8	83.24	-8.665	24.29	247.9	60.1	1,086	5.1
B	18,128	5.16		29.09		21.38				
C	18,138	9.83		108.92		22.63				
Total	12,644	8.75	333.1	99.87	-5.039	23.98	199.1	24.9	2,010	10.1
Assistant										
A	10,024	11.94	764.6	168.24	-11.293	24.27	315.9	76.2	1,172	4.7
B	12,317	10.71	897.1	128.19	-16.233	23.82	158.1	61.5	1,342	5.7
C	15,843	14.55	503.9	253.25	-8.646	22.65	52.0	19.0	2,414	10.9
Total	12,117	12.05	653.1	168.65	-11.789	23.75	228.0	33.9	2,077	8.9
Associate										
A	15,819	17.41	606.4	347.56	-8.056	24.52	238.8	78.5	992	3.4
B	21,315	16.27	420.4	291.6	-5.113	24.68	117.4	30.3	1,699	5.7
C	17,659	20.72	668.3	470.34	-8.224	22.54	60.8	15.7	2,563	8.8
Total	17,229	18.84	555.7	399.08	-7.695	23.7	195.8	28.2	2,431	8.3
Full professor										
A	22,729	25.87	359.8	725.6	-2.279	24.52	159.3	62.7	1,322	3.9
B	19,673	23.16	789.7	573.53	-9.665	25.22	148.4	59.9	1,581	4.4
C	20,101	29.34	1,026.5	910.34	-13.757	23.5	-45.6	17.4	3,466	9.5
Total	22,461	26.87	765.3	775.85	-7.680	23.89	-18.9	35.4	3,371	9.2
All ranks										
A	9,076	17.29	1,073.6	380.79	-13.776	24.23	253.2	84.1	2,064	7.2
B	7,119	13.94	1,289.5	233.22	-18.539	24.28	256.8	74.4	2,466	9.1
C	9,384	19.88	992.9	463.23	-10.303	22.72	153.1	56.5	3,950	14.1
Total	8,997	17.61	1,005.7	383.06	-10.373	23.78	231.2	64.5	3,664	13.0

a For bachelor's degree

Table 3

Determination coefficients (R^2) of the estimated models

Rank / Model \ University	A	B	C	Total
Lecturer				
age	62.0*	-6.1	-7.3	24.7
experience	41.4	19.0	-5.0	17.9
bachage	60.1	17.6	-10.3	24.9*
Assistant				
age	73.8	46.8	15.5	31.1
experience	66.9	57.1	19.3*	26.9
bachage	76.2*	61.5*	19.0	33.9*
Associate				
age	78.6*	27.9	30.7	28.1
experience	68.9	26.6	35.7*	23.6
bachage	78.5	30.3*	35.7*	28.2*
Full professor				
age	61.7	54.8	19.1*	29.7
experience	58.6	55.3	18.3	35.5*
bachage	62.7*	59.9*	17.4	35.4
Total				
age	81.9	66.8	52.4	61.5
experience	82.3	71.4	56.0	63.2
bachage	84.1*	74.4*	56.5*	64.5*

The differences in the values of R^2 from one university to another can be interpreted as indicating the relative weakness of a given model as an analytical tool for describing the policies or practices that are specific to a given institution. One should rather interpret these differences as another measure of the difference between universities as far as salary policy is concerned. In fact, one institution may have practices in determining individual salaries which can result in a dispersion around the regression equation which may be significantly larger than it is in another university. This could be considered as an institutional characteristic, compatible with the fact that its salary policy could be considered, on the whole, once the main characteristics of the faculty have been accounted for, to be equivalent to that of another university where the dispersion is smaller. The conditions on which such a statement depends is to make sure that the usual tests of the quality of the regression (the R^2) and of the significance of the coefficients (and even a judgment on their likelihood) insures the validity of the estimated results for the purpose of describing salary practices.

2.2 <u>The estimated coefficients and the analysis of distribution and salary effects</u>.

In order to set the problem in terms analogous with those used in the first part of this paper, it is helpful to present a general formulation of a regression model. In this framework, the models presented in the previous section are particular cases. This presentation is as follows:

$$T_i = \left(1 \; X_{1i} \; X_{2i} \cdots \; X_{ki} \cdots\right) \begin{pmatrix} \beta_0 \\ \beta_2 \\ \vdots \\ \beta_k \end{pmatrix} + u_i \qquad (12)$$

where the X_{ki} represent the values of the k^{th} variable for individual observation i, $\beta_0, \ldots \beta_k$ the coefficients of these variables.

We mentioned that the models presented in the previous sections could be represented by this general formulation in the sense that the vectors of variables are the following:

Model	Variables
FIXED VALUE	$\begin{bmatrix}1\end{bmatrix}$
PROPORTIONAL	$\begin{bmatrix}0 & AGE_i\end{bmatrix}$ or $\begin{bmatrix}1 & 0 & EXP_i\end{bmatrix}$
LINEAR	$\begin{bmatrix}1 & AGE_i\end{bmatrix}$ or $\begin{bmatrix}1 & 0 & EXP_i\end{bmatrix}$
AGE	$\begin{bmatrix}1 & AGE_i & 0 & AGE_i^2\end{bmatrix}$
EXPERIENCE	$\begin{bmatrix}1 & 0 & EXP_i & 0 & EXP_i^2\end{bmatrix}$
BACHAGE	$\begin{bmatrix}1 & 0 & EXP_i & 0 & EXP_i^2 & BACHAGE_i\end{bmatrix}$

The vectors of coefficients are defined in a compatible fashion. It is then possible to write this general presentation in a more compact matrix notation:

$T_i = X_i B + u_i$ where X_i and B denote the vectors presented in equation (12).

But, there is an important property of the regression model that states: the regression line "passes through the point of means", that is, translated in concrete terms, when the value of all the variables correspond to the mean of these variables, the estimated parameters ($\hat{B}$) generate a value of the dependant variable that is the mean of this variable, and the value of the residual term u_i is zero. It is then possible to write:

$$\bar{T} = \bar{X}\hat{B} = \begin{bmatrix}1 & \bar{X}_1 & \bar{X}_2 & \dots & \bar{X}_k\end{bmatrix} \begin{bmatrix}\hat{B}_0 \\ \hat{B}_1 \\ \hat{B}_2 \\ \vdots \\ \hat{B}_k\end{bmatrix} \qquad (13)$$

This statement could be interpreted this way: if the "average professor" existed, in the sense that all his personnal characteristics corresponded to the average characteristics of the group of which he is a member, and if his salary were determined by the process applied for all individuals, then this salary would be equal to the average salary of the group.

From then on, it is easy to see the kind of algebraic development one can undertake to split the difference between average salaries into a distribution effect and a salary effect. Indeed, we have

$$\bar{T}_u = \bar{X}_u \hat{B}_u \text{ and } \bar{T}_r = \bar{X}_r \hat{B}_r \qquad (14)$$

then

$$\bar{T}_u - \bar{T}_r = \bar{X}_u (\hat{B}_u - \hat{B}_r) + (\bar{X}_u - \bar{X}_r) \hat{B}_r \qquad (15)$$

where

$\bar{X}_u (\hat{B}_u - \hat{B}_r)$ will be a measure of the difference in average salary attribuable to the salary effect and

$(\bar{X}_u - \bar{X}_r) B_r$ a measure of the difference in average salaries attribuable to the distribution effect

The remarks made in the previous section, about the fact that the results vary when we compare university B to university A instead of university A to university B, still hold. Specifically, we still have here a "joint effect", corresponding to the differences between the results obtained for both components of the difference between average salaries when the terms of reference are reversed. This effect is:

$$\pm(\bar{X}_u - \bar{X}_r) (\hat{B}_u - \hat{B}_r) \qquad (16)$$

As in the first exercice, it is possible to insert the joint effect in the equation which develops the difference between average salaries:

$$\bar{T}_u - \bar{T}_r = (\bar{X}_u - \bar{X}_r)\hat{B}_r + \bar{X}_r(\hat{B}_u - \hat{B}_r) + (\bar{X}_u - \bar{X}_r) (\hat{B}_u - \hat{B}_r) \qquad (17)$$

It is also possible to split the joint effect into two parts and obtain symmetrical results for both the distribution effect and the salary effect, that is, results which have the same absolute value regardless of the order in which the universities are compared. We simply have to compare the salary structure for equal distribution, that is by averaging the mean value of the variables to find a conversion vector for the simple difference between coefficients, and by doing the reciprocal for the distribution differences. We have:

$$\bar{Y}_u - \bar{Y}_r = \left(\frac{\bar{X}_u + \bar{X}_r}{2}\right) (\hat{B}_u - \hat{B}_r) + (\bar{X}_u - \bar{X}_r) \left(\frac{\hat{B}_u + \hat{B}_r}{2}\right) \quad (18)$$

2.3 The results

The three regression models presented were applied twice to the 9 universities of the Quebec higher education system: first to the observations within each rank; second to the whole population of each university, regardless of rank. These two exercises give different results and the comparison of these results is itself an interesting way of exploring the differences in salary structures.

Applying the regression model within each rank simply breaks down a differential which has been previously presented, in the first part of this paper, as a simple difference between average salaries. It was mentioned at that time that in this first exercise we assumed that the mean salary adequately represented the salary structure within each rank. Now this assumption is relaxed and the regression models are applied to find out and measure differences in average salary that would be attributable to differences in age or experience.

Since the exercise presented in part one produced a distribution effect due to the distribution of faculty by rank and some kind of a residual salary effect, and since the application of the regression model breaks this last salary effect in two parts, the difference between agregate average salaries will include, after the exercise, three components:

- the distribution by rank effect
- the distribution by age and experience effect inside ranks, and
- the salary effect

Using the previously presented notation, these three components could be represented as:

$$\bar{Y}_u - \bar{Y}_r = (w_u - w_r)'\bar{Y}_r$$

(difference attributable to the distribution by rank)

$$+ \begin{bmatrix} w_u^1 & w_u^2 & w_u^3 & w_u^4 \end{bmatrix} \begin{bmatrix} (\bar{X}_u^1 - \bar{X}_r^1)\,\hat{\beta}_r^1 \\ (\bar{X}_u^2 - \bar{X}_r^2)\,\hat{\beta}_r^2 \\ (\bar{X}_u^3 - \bar{X}_r^3)\,\hat{\beta}_r^3 \\ (\bar{X}_u^4 - \bar{X}_r^4)\,\hat{\beta}_r^4 \end{bmatrix} \qquad (19)$$

(difference attributable to the distribution within ranks)

$$+ \begin{bmatrix} w^1 & w^2 & w^3 & w^4 \end{bmatrix} \begin{bmatrix} \bar{X}_u^1\,(\hat{\beta}_u^1 - \hat{\beta}_r^1) \\ \bar{X}_u^2\,(\hat{\beta}_u^2 - \hat{\beta}_r^2) \\ \bar{X}_u^3\,(\hat{\beta}_u^3 - \hat{\beta}_r^3) \\ \bar{X}_u^4\,(\hat{\beta}_u^4 - \hat{\beta}_r^4) \end{bmatrix}$$

(difference attributable to the salary effect)

The second exercise, where the regression model is applied to the total population of each university, implies some kind of standardization over ranks in the sense that observed salaries are regressed against the number of years of experience and the age when Bachelor's degree was obtained, regardless to the rank. Since the observed salaries of faculty of a given rank enter in the computations together with those of all other ranks, one can expect the results to differ from those of the first exercise.

To illustrate the breakdown of differences in average salary, we used the regression coefficients of the model presented in Table 4. For ranks where the tests indicated that the model was of poor descriptive quality, the average salary was considered the best representation of the salary structure.

To see how the method is applied, the computation of salary effect, in the rank of associate professor in university A, is as follows:

$$\begin{bmatrix} \$\ 15{,}819 - \$\ 17{,}229 \\ 606.4 - 555.7 \\ -8.056 + 7.695 \\ 238.8 - 195.8 \end{bmatrix}' \begin{bmatrix} 1 \\ 17.41 \\ 347.56 \\ 24.52 \end{bmatrix} = \$402$$

and the distribution effect:

$$\begin{bmatrix} 0 \\ 17.41 - 18.84 \\ 347.56 - 399.08 \\ 24.52 - 23.7 \end{bmatrix}' \begin{bmatrix} 17{,}229 \\ 555.7 \\ -7.695 \\ 195.8 \end{bmatrix} = \$238$$

Table 6 presents the results of this operation for each rank and each university. The bottom lines present the weighted summations of the results in each rank.

Table 7 presents the results of the exercise with all ranks taken together. These results are compared to those obtained in the first exercise. The following figure presents the method of grouping the results of the first exercise to make the comparison possible.

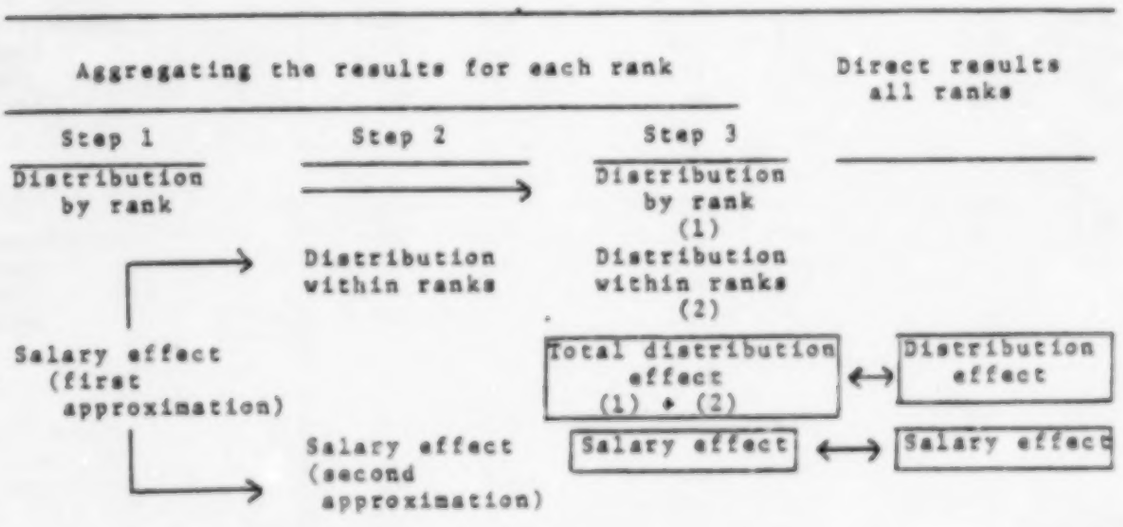

Table 6

Breakdown of the difference between the average salaries in three Quebec universities and the average salaries in all universities*, 1977-78: distribution effect and salary effect

	University A		University B		University C	
	$	%	$	%	$	%
Average salary	28,574		27,002		27,832	
Distribution by rank (1)	435	1.5	-1,332	-4.9	152	0.6
Within ranks:						
Rank 1	21,280		18,128		18,138	
distribution	-24	-0.1	-959	-5.3	45	0.3
salary	1,474	6.9	-749	-4.1	1,737	-9.6
total	1,450	6.8	-1,702	-9.4	-1,692	9.3
weight	.16		.04		.05	
Rank 2	24,918		23,609		22,165	
distribution	52	0.2	-382	-1.6	385	1.7
salary	1,455	5.8	579	2.4	-1,635	-7.4
total	1,507	6.0	197	0.8	-1,250	-5.6
weight	.23		.47		.27	
Rank 3	29,432		29,563		29,009	
distribution	-238	-0.8	-409	-1.4	269	0.9
salary	402	1.4	703	2.4	-529	-1.8
total	164	0.6	294	1.0	-260	-0.9
weight	.30		.39		.53	
Rank 4	34,289		36,164		36,625	
distribution	-391	-1.1	-1,311	-3.6	865	2.4
salary	-1,934	-5.7	858	2.4	-856	2.3
total	-2,325	-6.8	-453	-1.2	9	.0
weight	.31		.10		.16	
Distribution effect (2)	-185	-0.6	-506	-1.9	382	1.4
Salary effect (3)	92	0.3	606	2.2	-936	-3.4
Total (1) + (2) + (3)	342	1.2	-1,232	-4.6	-402	-1.4

*Where the average salary is $28,234

Table 7

The difference between average salaries in three Quebec universities and the average salary for all universities:* two exercises

		Average salary	Difference with $28,234	Distribution effect by rank	Distribution effect all rank	Salary effect by rank	Salary effect all rank
A	$	28,675	341	250	-148	92	495
	%		1.2	0.9	-0.5	0.3	1.7
B	$	27,002	-1,232	-1,838	-2,021	606	795
	%		-4.6	-6.8	-7.5	2.2	2.9
C	$	27,832	-402	534	1,206	-936	-1,609
	%		-1.4	1.9	3.4	-3.4	-5.8

* $28,234

The difference between the results obtained from the two exercises may be large enough to require more investigation. Although the signs of the results do not change, there are still some large variations. We should thus explain the following differences between the two exercises:

495 - 92 = 403
795 - 606 = 189
-1,609 + 936 = -673

All these differences are due to differences in the distribution of residuals between observed salaries and estimated salaries when we have one curve for all ranks and the residuals when one equation is estimated for each rank. Promotion from one rank to another usually corresponds to a step in the salary scale, so that the curve for all ranks is steeper than what is estimated in each rank. This step is smoothed in the "all ranks" exercise. It is then evident that the rank by rank exercise is more precise, but if the regression over ranks allows us to standardize differences in promotion policies the latter would be preferred for purposes of comparison. Irrespective to these differences, it is possible to breakdown the difference between results of the two exercises by using the method previously

presented, first by analysing the salary differences between one university and itself, or all universities and themselves, when comparing the salary structure by rank to the overall salary structure, and, second, by aggregating these differences over ranks.

Since the overall average values of the variables used in the regression models are the weighted average of those values in each rank, it is possible to derive from previous equations a new equation which explains the difference between the results obtained. For the salary differential, we have to compute:

$$\sum_{j=1}^{4} \bar{X}_u^j \quad (\hat{B}_u - \hat{B}_u^j) - (\hat{B}_r - \hat{B}_r^j) \; w_u^j \qquad (20)$$

where"j" refers to rank j (j = 1,...,4)

Table 8 presents the results of this compensation exercise. We find that, with 1 exception out of 16 cases, for all population and for all sub-populations, the overall exercise overestimates the salary differentials for lower ranks and underestimates it for higher ranks. This stems from the fact that we have persons with low experience in ranks above rank 1 and persons with high experience in ranks below the senior rank. This systematic bias could be used as a rationale for preferring the exercise made rank by rank.

The answer to the initial question about the relative salary is then summarized by the following indices of the salary level for each university:

University A	$28,326	100.3
University B	$28,840	102.1
University C	$27,388	97.0
All universities	$28,234	100.0

Table 8

Analysis of the differences between all-ranks analysis and by-rank breakdown of differences between average salaries in three Quebec universities

University	Lecturer	Assistant	Associate	Full professor	Total
University A					
Weight	.16	.23	.30	.31	1.00
In university	1,647	802	-244	-1,227	-404
All universities	2,231	1,406	-460	-3,067	-1
difference	-584	-604	216	1,840	-403
University B					
Weight	.04	.47	.39	.10	1.00
In university	1,110	1,060	-530	-3,334	-189
All universities	419	914	-818	-3,133	-2
Difference	691	146	288	-201	-187
University C					
Weight	.05	.27	.53	.16	1.00
In university	3,349	2,526	-447	-3,889	672
All universities	3,110	2,441	630	-2,985	-2
Difference	239	85	-1,077	-904	674

CONCLUSION

As far as policy issues are concerned, the kind of analysis presented here can help decision makers by providing comparative information in the familiar percentage figures which explicitly states the difference in salary cost attributable to differences in the structure of the faculty, by discipline, academic rank, age, experience, and the difference not attributable to these previous variables, namely the salary differential. Thus, explicitly presenting the distribution effect may result in a more qualified appreciation of the salary effect, in other words, it helps to have a more complete appreciation of the differences between average salary, that is a complete disaggregation of what is a matter or structural differences and what is "strictly" monetary when making comparisons of wage bills between universities.

From the point of view of information exchange, this method has the advantage of satisfying the confidentiality criterion while producing information that is sufficiently accurate and complete enough for the administrator who works with gross and meaningful figures like number of teachers and average salary. The following tables are presented to illustrate what was said about confidentiality. The salary scales are generated by the estimated regression coefficients. The number of persons are exact figures and, knowing the properties of regression estimators, the total estimated salaries paid correspond to the real total, even if, for a category where there is only one observation, the estimated salary is different than the one observed. These tables present in a more readable form the results of the estimated regression model. It is therefore possible to look at the exercises which were presented as an effort to use different quantitative tools in an integrated way, more specifically, as an effort to bridge the gap between simple comparison of average figures and regression analysis, which is sometimes considered as an expert activity.

Table 9
Estimated* salary scale: university A

PE PE RI EN CE	CHARGE D'ENSEIGNEMT			ADJOINT			AGREGE			TITULAIRE			TOTAL		
	N	$	INDICE	N	$	INDICE	N	$	INDICE	N	$	INDICE	N	$	INDICE
2	4	18770	.931										4	16991	.843
3	11	19188	.951										11	17996	.892
4	11	19588	.971	1	20167	1.000							12	18973	.941
5	6	19971	.990	1	20830	1.033							9	19923	.988
6	13	20336	1.008	6	21470	1.065							19	20845	1.034
7	24	20684	1.026	9	22098	1.095							33	21739	1.078
8	13	21015	1.042	18	22693	1.125							31	22606	1.121
9	18	21329	1.058	32	23256	1.153	6	26116	1.295				56	23446	1.163
10	13	21625	1.072	18	23806	1.180	13	26589	1.317				44	24257	1.203
11	11	21904	1.086	31	24333	1.207	20	27007	1.339				62	25042	1.242
12	10	22165	1.099	24	24838	1.232	25	27428	1.360	3	30382	1.507	62	25799	1.279
13	4	22409	1.111	12	25320	1.256	30	27833	1.380	2	30685	1.522	48	26528	1.315
14	3	22636	1.122	11	25780	1.278	23	28222	1.399	1	30983	1.536	38	27229	1.350
15	1	22846	1.133	9	26217	1.300	15	28594	1.418	9	31277	1.551	33	27903	1.384
16	2	23038	1.142	5	26632	1.321	21	28951	1.436	6	31566	1.565	34	28550	1.416
17				4	27024	1.340	10	29292	1.452	8	31850	1.579	22	29169	1.446
18				6	27393	1.358	15	29616	1.469	18	32130	1.593	39	29760	1.476
19				1	27740	1.376	15	29924	1.484	21	32406	1.607	37	30324	1.504
20				3	28064	1.392	11	30218	1.498	10	32677	1.620	24	30861	1.530
21				1	28366	1.407	5	30491	1.512	18	32943	1.634	23	31369	1.555
22	1	23827	1.181	1	28645	1.420	6	30753	1.525	18	33205	1.646	26	31851	1.579
23				1	28901	1.433	8	30996	1.537	12	33462	1.659	21	32304	1.602
24	1	23951	1.188				6	31224	1.548	12	33715	1.672	19	32731	1.623
25							2	31436	1.559	12	33963	1.684	14	33129	1.643
26				1	29535	1.465	2	31631	1.568	9	34207	1.696	12	33500	1.661
27	1	24008	1.190				7	31811	1.577	10	34446	1.708	18	33844	1.678
28							5	31974	1.585	9	34680	1.720	14	34160	1.694
29				2	29965	1.486	1	32121	1.593	8	34910	1.731	13	34448	1.708
30				1	30063	1.491	2	32252	1.599	15	35135	1.742	18	34709	1.721
31							5	32367	1.605	11	35336	1.753	16	34942	1.733
32				1	30192	1.497	1	32466	1.610	8	35572	1.764	10	35148	1.743
33							3	32569	1.615	4	35784	1.774	7	35326	1.752
34							1	32616	1.617	7	35991	1.785	8	35476	1.759
35				1	30216	1.498				8	36194	1.795	9	35599	1.765
36										7	36392	1.805	7	35695	1.770
37							2	32719	1.622	8	36585	1.814	10	35763	1.773
38							4	32721	1.623	6	36774	1.823	10	35803	1.775
39										4	36958	1.833	4	35816	1.776
40				1	29904	1.478				4	37138	1.842	5	35801	1.775
41							1	32631	1.618	2	37313	1.850	3	35759	1.773
42										2	37484	1.859	2	35689	1.770

*(assuming that the Bachelor's degree was obtained at 23)

Table 10

Estimated* salary scale: university B

EX Pr 01 FN CE	CHARGE D'ENSEIGNEMENT N	$	INDICE	ADJOINT N	$	INDICE	AGREGE N	$	INDICE	TITULAIRE N	$	INDICE	TOTAL N	$	INDICE
3	3	18128	.940										3	16727	.867
4	9	18128	.940	4	19281	1.000							13	17886	.928
5	9	18128	.940	11	20032	1.039							20	19009	.986
6	7	18128	.940	17	20751	1.076							24	20094	1.042
7	2	18128	.940	31	21437	1.112	3	26707	1.385				36	21143	1.097
8	1	18128	.940	40	22091	1.146	1	27051	1.403				42	22154	1.149
9				51	22712	1.178	1	27384	1.420				52	23129	1.200
10				52	23300	1.208	17	27707	1.437				69	24066	1.248
11	1	18129	.940	65	23857	1.237	18	28020	1.453				84	24966	1.295
12				52	24380	1.264	27	28323	1.469				79	25829	1.340
13				24	24872	1.290	41	28616	1.484	3	31718	1.645	68	26655	1.382
14				19	25331	1.314	52	28898	1.499	2	32241	1.672	63	27444	1.423
15				7	25757	1.336	39	29170	1.513	2	32757	1.699	48	28196	1.462
16				11	26151	1.356	29	29432	1.526	4	33247	1.724	44	28911	1.499
17				5	26512	1.375	26	29684	1.539	4	33717	1.749	36	29589	1.535
18				4	26841	1.392	20	29925	1.552	6	34169	1.772	30	30229	1.568
19				2	27138	1.407	10	30157	1.564	3	34601	1.794	15	30833	1.599
20							10	30377	1.575	6	35014	1.816	16	31399	1.628
21				3	27633	1.433	8	30588	1.586	6	35407	1.836	17	31929	1.656
22				1	27832	1.443	10	30769	1.597	4	35781	1.856	15	32421	1.681
23							9	30979	1.607	8	36136	1.874	17	32876	1.705
24				3	28133	1.459	6	31159	1.616	6	36471	1.892	15	33294	1.727
25							2	31329	1.625	9	36788	1.908	11	33676	1.747
26				1	28304	1.468	4	31489	1.633	1	37084	1.923	6	34020	1.764
27							2	31638	1.641	7	37362	1.938	9	34326	1.780
28							2	31777	1.648	4	37620	1.951	6	34598	1.794
29							3	31906	1.655				3	34829	1.806
30				1	28256	1.465	1	32025	1.661	2	38078	1.975	4	35025	1.816
31							3	32134	1.667				3	35183	1.825
32							2	32232	1.672	1	38459	1.995	3	35305	1.831
33										2	38621	2.003	2	35389	1.835
34							1	32398	1.680	1	38763	2.010	2	35437	1.838
35							1	32465	1.684	1	38885	2.017	2	35447	1.838
36				1	27210	1.411	2	32523	1.687				3	35420	1.837
37										1	39073	2.026	1	35357	1.834
39							1	32633	1.692	2	39184	2.032	3	35118	1.821
42										1	39284	2.033	1	34481	1.788

*(assuming that the Bachelor's degree was obtained at 23)

Table 11

Estimated* salary scale: university C

EF / PE / RI / EN / CF	CHARGE D'ENSEIGNEMENT N	%	INDICE	ADJOINT N	%	INDICE	AGREGE N	%	INDICE	TITULAIRE N	%	INDICE	TOTAL N	%	INDICE
4	1	18138	.959										1	16712	.883
5	1	18138	.959	1	19342	1.023							2	17612	.931
6	3	18138	.959	2	19751	1.044							5	18491	.978
7	2	18138	.959	7	20142	1.065							9	19350	1.023
8	2	18138	.959	5	20516	1.085							7	20189	1.067
9	3	18138	.959	10	20873	1.103	2	24405	1.290				15	21006	1.111
10	3	18138	.959	12	21213	1.121	5	24917	1.317				20	21803	1.153
11	2	18138	.959	10	21535	1.138	3	25513	1.353				15	22580	1.194
12	2	18138	.959	11	21840	1.155	4	25892	1.369				17	23336	1.234
13	1	18138	.959	14	22128	1.170	18	26355	1.393				33	24071	1.273
14	1	18138	.959	9	22398	1.184	16	26801	1.417	1	30726	1.624	27	24786	1.310
15				6	22652	1.197	13	27231	1.440	1	31354	1.658	20	25480	1.347
16	2	18138	.959	6	22888	1.210	15	27644	1.461				23	26154	1.383
17	1	18138	.959	8	23106	1.222	18	28041	1.482	1	32526	1.720	28	26807	1.417
18				2	23307	1.232	11	28422	1.503				13	27439	1.451
19				7	23491	1.242	12	28786	1.522	2	33589	1.776	21	28051	1.483
20				2	23658	1.251	18	29133	1.540	5	34079	1.802	23	28642	1.514
21				2	23804	1.259	10	29464	1.558	3	34541	1.826	15	29212	1.544
22				4	23940	1.266	16	29779	1.574	5	34976	1.849	25	29762	1.573
23				1	24054	1.272	15	30077	1.590	4	35384	1.871	20	30291	1.601
24							10	30359	1.605	2	35764	1.891	12	30800	1.628
25							13	30624	1.619	5	36116	1.909	18	31288	1.654
26				1	24295	1.284	14	30873	1.632	1	36441	1.926	16	31755	1.679
27							6	31106	1.644	2	36738	1.942	8	32202	1.702
28				1	24369	1.288	8	31322	1.656	1	37008	1.956	10	32628	1.725
29							5	31521	1.666	7	37251	1.969	11	33034	1.746
30				2	24376	1.289	6	31704	1.676	4	37465	1.981	12	33419	1.767
31				3	24351	1.287	7	31871	1.685	6	37653	1.991	16	33784	1.786
32				1	24310	1.285	1	32021	1.693	3	37813	1.999	5	34127	1.804
33				1	24252	1.282	4	32155	1.700	2	37949	2.006	6	34451	1.821
34				1	24176	1.278	1	32272	1.706	3	38050	2.012	5	34753	1.837
35							1	32373	1.711	2	38127	2.016	3	35035	1.852
36				1	23974	1.267	1	32457	1.716	1	38177	2.018	5	35297	1.866
37										4	38199	2.019	4	35537	1.879
38										2	38194	2.019	3	35757	1.890
39							2	32612	1.724	4	38161	2.017	6	35957	1.901
40							1	32630	1.725	1	38101	2.014	2	36136	1.910
41										1	38013	2.010	1	36296	1.919
42										1	37897	2.003	1	36432	1.926

*(assuming that the Bachelor's degree was obtained at 23)

Table 12

Estimated* salary scale: all Quebec universities

ÉCHELON	CHARGE D'ENSEIGNEMENT			ADJOINT			AGRÉGÉ			TITULAIRE			TOTAL		
	N	$	INDICE	N	$	INDICE	N	$	INDICE	N	$	INDICE	N	$	INDICE
2	*	17869	.903										8	16284	.823
3	24	18177	.919										24	17238	.871
4	30	18475	.934	8	19794	1.000							38	18171	.918
5	30	18762	.948	22	20331	1.028							52	19083	.965
6	31	19040	.962	41	20859	1.054							72	19975	1.010
7	41	19308	.976	73	21355	1.079	3	25245	1.276				117	20846	1.054
8	30	19565	.989	104	21831	1.103	5	25685	1.298				139	21696	1.097
9	33	19813	1.001	139	22283	1.126	15	26110	1.320				187	22525	1.139
10	25	20050	1.013	148	22713	1.148	48	26519	1.340				221	23334	1.179
11	22	20277	1.025	165	23118	1.169	53	26914	1.360				240	24122	1.219
12	20	20494	1.036	137	23500	1.188	101	27292	1.379	4	30103	1.522	262	24889	1.258
13	14	20702	1.046	88	23858	1.206	122	27656	1.398	5	30677	1.551	229	25635	1.296
14	11	20899	1.056	71	24193	1.223	142	28003	1.415	9	31235	1.579	233	26361	1.332
15	5	21086	1.066	67	24504	1.239	125	28336	1.432	15	31777	1.606	192	27066	1.368
16	9	21262	1.075	39	24792	1.253	121	28653	1.448	19	32305	1.633	187	27750	1.403
17	2	21429	1.083	42	25056	1.266	109	28955	1.464	20	32816	1.659	173	28413	1.436
18	1	21586	1.091	25	25297	1.279	95	29241	1.478	39	33313	1.684	160	29056	1.469
19	1	21733	1.098	23	25514	1.290	88	29512	1.492	41	33794	1.708	153	29678	1.500
20				19	25707	1.299	82	29769	1.505	42	34260	1.732	143	30279	1.530
21	2	21996	1.112	10	25877	1.308	64	30008	1.517	42	34710	1.754	118	30659	1.560
22	3	22112	1.118	17	26023	1.315	66	30233	1.528	48	35145	1.776	134	31419	1.588
23				8	26145	1.322	69	30442	1.539	41	35565	1.798	118	31958	1.615
24	3	22315	1.128	6	26244	1.327	42	30636	1.549	46	35969	1.818	97	32476	1.641
25				2	26320	1.330	39	30815	1.558	40	36358	1.838	81	32973	1.667
26	1	22477	1.136	5	26372	1.333	38	30978	1.566	33	36732	1.857	77	33450	1.691
27	1	22543	1.139	1	26400	1.334	30	31126	1.573	47	37090	1.875	79	33906	1.714
28	4	22599	1.142	1	26405	1.335	24	31259	1.580	35	37433	1.892	64	34341	1.736
29				3	26386	1.334	27	31376	1.586	37	37761	1.909	67	34756	1.757
30				6	26343	1.332	25	31477	1.591	44	38073	1.924	75	35149	1.777
31				4	26277	1.328	23	31564	1.595	47	38370	1.939	74	35522	1.795
32				2	26188	1.324	13	31635	1.599	24	38651	1.954	39	35875	1.813
33				1	26075	1.318	12	31690	1.602	20	38917	1.967	33	36206	1.830
34				1	25938	1.311	9	31730	1.604	19	39168	1.980	29	36517	1.846
35				1	25777	1.303	6	31755	1.605	25	39403	1.992	30	36807	1.860
36				2	25594	1.294	8	31764	1.606	23	39623	2.003	33	37076	1.874
37							7	31758	1.605	26	39828	2.013	33	37324	1.887
38							8	31737	1.604	21	40017	2.023	29	37552	1.898
39				1	24900	1.259	6	31700	1.602	19	40191	2.031	26	37759	1.909
40				1	24622	1.245	7	31648	1.600	9	40350	2.039	16	37945	1.918
41							5	31590	1.598	9	40493	2.047	14	38111	1.926
42							5	31497	1.592	6	40621	2.053	11	38256	1.934

*(assuming that the Bachelor's degree was obtained at 23)

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